Advanced Concept Studies for Commercial Transports Entering Service in the 2030-35 Period Supersonics Perspective

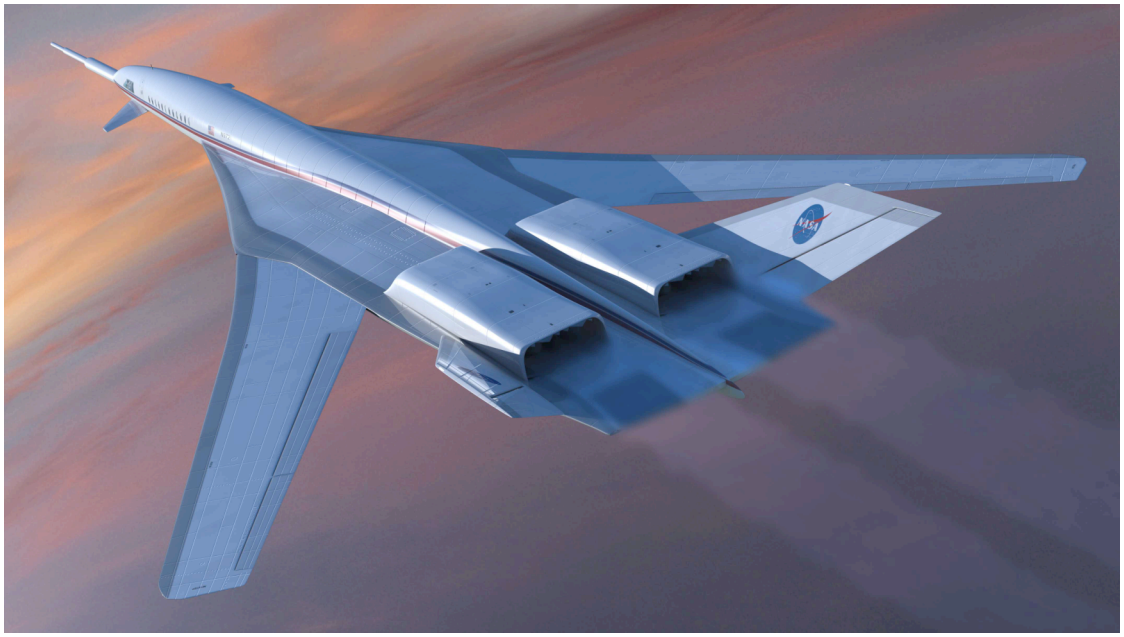
Fundamental Aeronautics Pre-Proposal Conference

Washington D.C.

November 29, 2007

Fundamental Aeronautics Supersonic Project

Project Goal: Tool and technology development for the broad spectrum of supersonic flight.



Supersonic Cruise Aircraft

Eliminate the efficiency, environmental and performance barriers to practical supersonic cruise vehicles

High Mass Planetary Entry Systems

Address the critical supersonic deceleration phase of future large payload Exploration and Science Missions

Supersonics Project Technical Challenges

The Supersonics technical challenge areas are designed to break the traditional discipline "stovepipes" and foster innovative solutions "at the seams" between disciplines

- **Efficiency Challenges - 30 % Improvement over HSR**
  - Supersonic Cruise Efficiency
  - Light Weight and Durability at High Temperature
- **Environmental Challenges - No greater impact than subsonic fleet**
  - Airport Noise: Acceptable levels without weight or performance penalty
  - Sonic Boom: Propagation, prediction and design
  - High Altitude Emissions: Emissions impact must be minimized or eliminated
- **Performance Challenges - Safe and comfortable flight for crew and passengers**
  - Aero-Propulso-Servo-Elastic (APSE) Analysis and Design: Controlling flutter, gust, and maneuver loads in a manner that is synergistic with the vehicle structural design
- **Entry Descent and Landing Challenges**
  - Supersonic Entry Deceleration: Develop tools and technologies to support the design and validation of exploration systems capable of landing payloads in the 30 metric ton class
- **System Integration, MDAO Challenges**
  - Understanding and exploiting the interactions of all these supersonic technology challenges is the key to the creation of practical designs

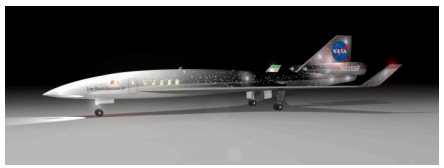
Configuration Study Objectives

- Foster the pursuit of highly innovative approaches to overcoming the challenges of making efficient, environmentally friendly supersonic air travel available to the broad traveling public.
- Identify the key technology development needs and opportunities that will enable the development of such aircraft.
    - Incorporate long term thinking into project technical portfolio
- Generate excitement!

NASA Developed Systems Level Requirements

	N+1 Supersonic Business Jet Aircraft (2015)	N+2 Small Supersonic Airliner (2020)	N+3 Efficient Multi-Mach Aircraft (2030-2035)
Cruise Speed	Mach 1.6-1.8	Mach 1.6-1.8	Mach 2.0 Unrestricted Flight 1.6-2.0 Low Boom
Range (nmi)	4,000	4,000	6,000
Payload	6-20 pax	35-70 pax	100-200 pax
Sonic Boom	65-70 PLdB	65-70 PLdB	65-70 PLdb low boom flight 75-80 PLdB unrestricted flight
Airport Noise (cum below Stage 3)	10 EPNdB	10-20 EPNdB	20-30 EPNdB
Cruise Emissions Cruise Nox EI	Equivalent to Subsonic	<10	<5
Other		?	?
Fuel Efficiency	Baseline	15% Improvement	25% Improvement

N+1 "Conventional"



N+2 Small Supersonic Airliner

N+3 Efficient Multi-Mach Aircraft

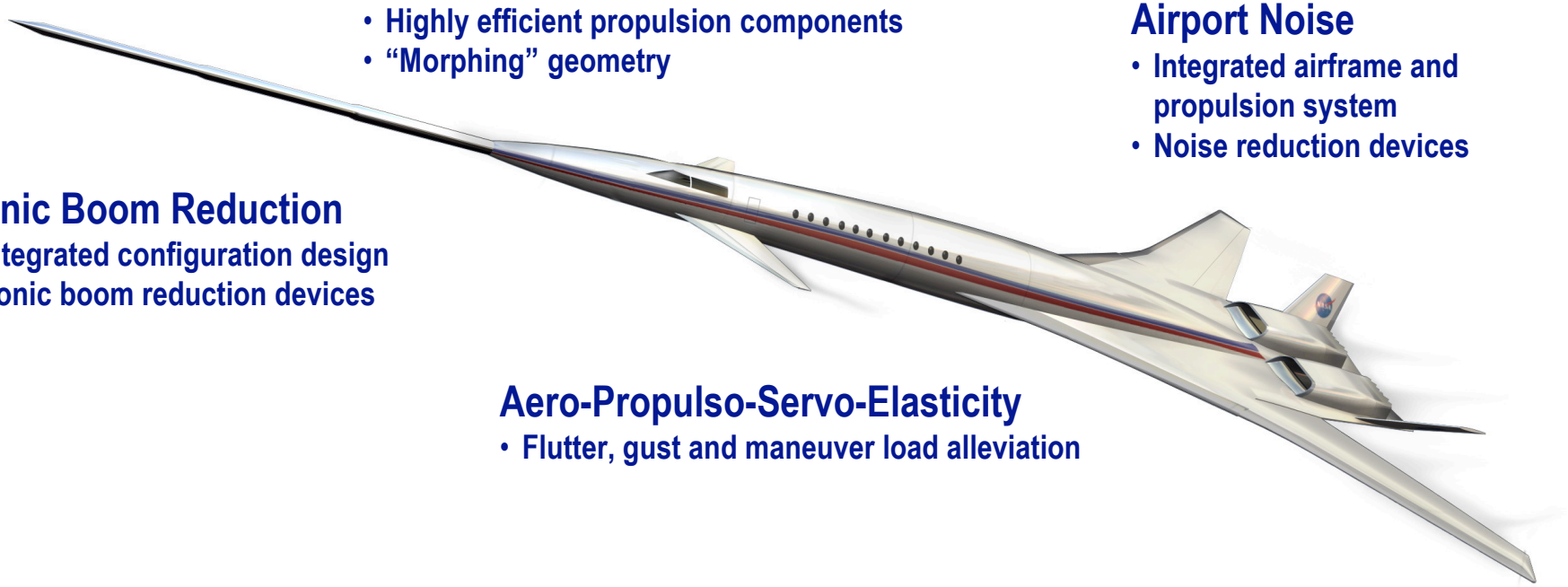
?

Potential N+3 Configuration Features

Advanced concepts, devices and technologies applied in highly integrated design

Cruise Efficiency
- Integrated hi-efficiency airframe/propulsion design
- Drag reduction technologies
- Highly efficient propulsion components
- "Morphing" geometry

Airport Noise
- Integrated airframe and propulsion system
- Noise reduction devices



Sonic Boom Reduction
- Integrated configuration design
- Sonic boom reduction devices

Aero-Propulso-Servo-Elasticity
- Flutter, gust and maneuver load alleviation

Light Weight Structure for Airframe and Propulsion System
- Multifunctional materials and structures
- Ultra-light weight components

High Altitude Emissions
- Low emissions combustors
- Low emission flight profiles